AMENDMENTS TO THE SPECIFICATION:

Page 1, please add the following new paragraphs before paragraph [0001]:

[0000.2] CROSS-REFERENCE TO RELATED APPLICATION

[0000.4] This application is a 35 USC 371 application of PCT/EP 2005/050480 filed on February 4, 2005.

[0000.6] BACKGROUND OF THE INVENTION

Please replace paragraph [0001] with the following amended paragraph:

[0001] ~~Prior Art~~ **Field of the Invention**

Please replace paragraph [0002] with the following amended paragraph:

[0002] The invention relates to a method for starting a sensorless, electronically commutatable direct current motor. ~~as generically defined by the preamble to claim 1. One such method is known for instance from the dissertation D 93 by Volker Bosch at the University of Stuttgart, entitled "Elektronisch kommutiertes Einzelspindelantriebssystem" [Electronically Commutated Single-Spindle Drive System], Shaker Verlag, Aachen, 2001. In such electronically commuted direct current motors, which do not detect the rotor position via sensors, the absolute position of the rotor at a standstill is not known. For initial positioning of the motor, the rotor is therefore first put in a predetermined outset position at the onset of the startup operation, which is done by supplying two or three phases of the motor with current, so that the rotor aligns itself accordingly. After a defined waiting period, a controlled startup of the motor then takes place by incremental delivery of current to further phases of the motor. The method for sensorless rotor position detection described in the aforementioned publication, however, on principle furnishes a reliable position signal only above a~~

~~predetermined minimum rpm of the rotor, and this method can therefore not be used directly for starting the motor. The motor startup is thus done in a controlled way rather than regulated; that is, blocking of the rotor cannot be immediately detected and corrected. For motors with variable loading, this known method is therefore only conditionally suitable.~~

Please add the following new paragraphs after paragraph [0002]:

[0002.2] Description of the Prior Art

[0002.4] One method of starting electronically commutated direct current motors is known for instance from the dissertation D 93 by Volker Bosch at the University of Stuttgart, entitled "Elektronisch kommutiertes Einzelspindelantriebssystem" [Electronically Commutated Single-Spindle Drive System], Shaker Verlag, Aachen, 2001. In such electronically commuted direct current motors, which do not detect the rotor position via sensors, the absolute position of the rotor at a standstill is not known. For initial positioning of the motor, the rotor is therefore first put in a predetermined outset position at the onset of the startup operation, which is done by supplying two or three phases of the motor with current, so that the rotor aligns itself accordingly. After a defined waiting period, a controlled startup of the motor then takes place by incremental delivery of current to further phases of the motor. The method for sensorless rotor position detection described in the aforementioned publication, however, on principle furnishes a reliable position signal only above a predetermined minimum rpm of the rotor, and this method can therefore not be used directly for starting the motor. The motor startup is thus done in a controlled way rather than regulated; that is, blocking of the rotor cannot be immediately detected and corrected. For motors with variable loading, this known method is therefore only conditionally suitable.

[0002.6] OBJECTS AND SUMMARY OF THE INVENTION

Please replace paragraph [0003] with the following amended paragraph:

[0003] [[The]] **A primary** object of the invention is to improve the known method in such a way that with the least possible engineering effort and expense, the startup of such a motor with sensorless rotor position detection can also be done in a regulated way, with the duration and amount of the supply of starting current being adaptable to the particular load on the motor. Besides rapid detection of blocking of the motor, a reliable startup under heavy load, or startup of the motor at low load, should be attained in the shortest possible time.

Please replace paragraph [0004] with the following amended paragraph:

[0004] ~~This object is attained by the definitive characteristics of claim 1. In particular~~ **In accordance with the invention**, it is now possible, by sensorless position detection of the rotor already at a standstill, to attain a reliable, load-dependent regulation of the startup operation of the motor, and furthermore, once a predetermined minimum value of the rotor rpm is exceeded, to employ an advantageous different kind of speed governing of the motor by means of evaluating the third and/or further odd-numbered harmonics of the phase voltages. For ascertaining the position of the rotor at a standstill, recourse may be had to a method known from German Patent Disclosure DE 101 62 380 A1, with which a preliminary delivery of current for rotating the rotor into a defined outset position is unnecessary. After the startup of the machine and especially at high rpm, however, this known method becomes very complex and requires a very high-powered, fast computer for ascertaining the current rotor position at the time, knowledge of which is necessary for the regulation.

Please 4, add the following new paragraph before paragraph [0008]:

[0007.5] BRIEF DESCRIPTION OF THE DRAWINGS

Please replace paragraph [0008] with the following amended paragraph:

[0008] Further details an advantageous features of the method of the invention will become apparent from the description of the exemplary embodiment ~~and from the dependent claims.~~ **contained herein below, taken in conjunction with the drawings, in which:**

Please delete paragraph [0009].

Please replace paragraph [0010] with the following amended paragraph:

[0010] Fig. 1[[,]] shows a three-phase, sensorless, electronically commutatable direct current motor with a permanent-magnetically excited rotor, and [[in]]

Please replace paragraph [0011] with the following amended paragraph:

[0011] Fig. 2[[,]] **shows** the basic course over time of the integrated analog rotor position signal during the startup.

Please add the following new paragraph after paragraph [0011]:

[0011.5] DESCRIPTION OF THE PREFERRED EMBODIMENT

Page 5, please replace paragraph [0013] with the following amended paragraph:

[0013] Via a further output of the inverter 14, the current in the direct voltage circuit, upon the imposition of current pulses on the phase windings U, V, W, is delivered to a measuring shunt 27, connected to ground, for ascertaining the rotor position at standstill of the machine. The voltage drop at the shunt 27 is compared in a comparator 25 with a reference voltage [[Uref]] **U_{ref}**, and the output signal of the comparator 25 is delivered, for ascertaining the rotor

standstill position, to a control device 54, where in accordance with the fastest current rise in the phase windings U, V, W, resulting from the position of the rotor, the rotor position can be determined. This method is described in detail in DE 101 62 380 A1, the discussions in which are incorporated by reference.

Please replace paragraph [0015] with the following amended paragraph:

[0015] The output of the integrator 46 is connected to a microcontroller (μC) of the control device 54, on the one hand via an A/D converter 50 and on the other via a comparator 52 with hysteresis. The microcontroller is supplied at further inputs with a signal 56 for the rated rpm of the machine as well as the output signal of the comparator 25. The outputs of the microcontroller are connected via a pulse width modulator 58, an up/down counter 60, and an enabling connection 61, to a transistor driver 62 for the inverter 14. The up/down counter 60 is moreover also connected to the output of the comparator 52. From the microcontroller of the control device 54, the up/down counter 60 receives signals about the rotor starting position, a charge signal, an enable signal, and a signal for the up and down counting, depending on the desired clockwise or counterclockwise rotation of the motor. All the connecting lines are represented by single lines; the actual number of lines for the individual connections is ~~represented~~ **designated** in each case by a **reference** number. The lead to the pulse width modulator 58 is marked 64; the lead to the counter 60 for the rotor starting position is marked 66; the lead for charging the counter is marked 68; the lead for the enabling of the counter is marked at 70; and the lead for the clockwise and counterclockwise rotation is marked 72.

Please replace paragraph [0017] with the following amended paragraph:

[0017] Before starting of the motor, first the current position at a standstill is ascertained, by means of the measurement shunt 27, a reference voltage [[Uref]] $\underline{U}_{ref}$, the comparator 25, and the microcontroller µC. One method suitable for this is described for instance in DE 101 62 380 A1. In it, first a plurality of brief current pulses is imposed via the inverter 14 on the phase windings U, V, W; upon each current pulse, a current rise occurs in the stator windings, whose rise speed is dependent on the position of the rotor 24. The times until a predetermined threshold is reached are measured at the comparator 25. A plurality of test current pulses is imposed in succession on the stator windings in such a way that the test current pulses generate stator magnetomotive force vectors in the stator that are offset by equal angular intervals over the course of 360°(el.). For each stator magnetomotive force vector, the current rise time in the direct voltage circuit being supplied is measured, and the phase relationship of the stator magnetomotive force vector having the shortest current rise time defines the rotor position. In detail, this method suitable for determining the standstill position of the rotor is described in detail in the aforementioned published reference and need not be described at length again here.

Page 7, please replace paragraph [0018] with the following amended paragraph:

[0018] After the rotor position has been determined and before the motor is started, the up/down counter 60 is acted upon, by the microcontroller of the control device 54, by a starting value which corresponds to the previously ascertained rotor starting position. The further method for starting the machine and governing its speed is then based on a method for

sensorless rotor position detection by evaluation of the third and/or further odd-numbered harmonics of the phase voltages of the motor. Because of the non-sinusoidal field distribution in the air gap, these phase voltages have harmonics, and because the exciter field distribution is symmetrical relative to the pole center, only the odd-numbered harmonics occur. Because of the trapezoidal to square wave course of the air gap flux density, the third harmonic of the flux density, which then also appears as a third harmonic in the phase voltages, has a considerable magnitude, while the remaining harmonics can as a rule **be** ignored here.

Page 12, please add the following new paragraph after paragraph [0026]:

[0027] The foregoing relates to a preferred exemplary embodiment of the invention, it being understood that other variants and embodiments thereof are possible within the spirit and scope of the invention, the latter being defined by the appended claims.